ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 1.] [1910.

I.—FUNGI EXOTICI: X.

(With Plate.)

G. Massee.

The majority of the new fungi, described in the following pages, have been received from the West Indies. A few are from Tropical Africa and elsewhere. *Marasmius scandens* is a parasite on Cacao in West Africa, and causes considerable damage to the plants. Another new fungus of interest is *Diplodia rapax*, which appears to be parasitic on the branches and roots of *Hevea brasiliensis*; this fungus was received almost simultaneously from Singapore and from West Africa. Two of the fungi described may be parasitic on insects, viz.: *Scleroderris gigaspora*, on scale insects on the leaves of the orange tree, and *Septocylindrium suspectum* on the bodies of "Frog-hoppers." Both these fungi require investigation under natural conditions as, if their true parasitism should be established, they may prove to be of some economic importance.

Agaricaceae.

Amanita calabarica, *Massee.*

Pileus carnosus, e convexo-hemispherico explanatus, glaber, siccus, margine striatus, luride alutaceus, aetate maculatus vel rimoso-areolatus, 6–7 cm. latus. *Lamellae* confertae, postice attenuato-liberae, albae, ventricosae, confertae, acie fimbriata, lamellulae numerosae subrotundatae. *Sporae* hyalinae, ellipsoideae, 7 × 5 μ. *Stipes* sursum attenuatus, cavus, albidus, subglaber, 5–6 cm. longus, deorsum 2 cm. crassus; annulus ampliatus, apicalis, persistens, supra striatus, subtus flocculosus.

Southern Nigeria. Old Calabar; on the ground in the Botanic Station, *J. H. Holland*, 48, with coloured fig.

Marasmius scandens, *Massee.*

Pileus minutissimus, circa 1 mm. latus, conchatus, albidus, resupinatus, pulverulentus, postremo striatus. *Lamellae* 3–5, angustissimae, interstitiis venosae. *Sporae* hyalinae, ellipsoideae, 4–5 × 3 μ. (Figs. 15–18.)

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Tropical Africa. Gold Coast; on branches of cacao tree, collected by Mr. A. E. Evans, Travelling Instructor; comm. *W. S. D. Tudhope.*

This fungus is not uncommon on indigenous species of *Cola*, and is supposed to have passed from the native plants to the cultivated cocoa, which suffers considerably from its presence.

The white cord-like mycelium extends along the surface of the branches, and produces at intervals the minute, resupinate pilei. Allied to *Marasmius aleurites*, Berk. & Cke.

Galera Burkillii, *Massee.*

Pileus carnoso-membranaceus, 1–1·5 cm. diametro, campanulatus, rigidulus, glaber, incarnatus, umbone versus saturatior, margine erecto acuto tenuissimo, ac majuscule striatus. *Lamellae* confertae, strictae, angustae, adnexae, ex albo ochraceae, acie dentatae. *Sporae* ellipsoideae, utrinque obtusissimae, ochraceae, 12–15 × 10–12 μ. *Stipes* farctus, aequalis, glaber, pallidus, 5–6 cm. longus, 1·5 mm. crassus.

India. Darjeeling, Sureil; on the ground, *I. H. Burkill*, 32200.

Readily distinguished amongst known species of *Galera* by the brightly coloured pileus and large spores. Allied to *Galera tener*, Fr.

Sphaeriaceae.

Xylaria Pattersonii, *Massee.*

Stromata erecta, gregaria vel sparsa; stipites glabri, atri, 1–2 cm. alti, basi mycelio atro fibroso vestiti; clavulae cylindraceo-clavulatae, apiculatae, nigrae, ruguloso-verrucosae, circiter 1 cm. longae. *Asci* cylindracei, sursum rotundati, deorsum in pedicello longiusculo attenuati, octospori. *Sporae* oblique monostichae, brunneae, ellipsoideae, ad latera subinaequilaterali-cymbiformae, 11–12 × 5–6 μ. (Figs. 6–8.)

West Indies. St. Vincent; on decayed fallen branches, *W. H. Patterson.*

Allied to *Xylaria aspera*, Massee; differing in the apiculate club, glabrous stem and larger spores.

Ophiobolus calathus, *Massee.*

Perithecia laxe gregaria, primo cortice immersa dein erumpenti-semiexserta, sphaeroideo-depressa, atro-olivacea, glaberrima, ostiolum cylindraceum longissimum gerentia. *Asci* fusoidei, deorsum breve attenuato-stipitati, 155–160 × 15–16 μ, octospori. *Sporae* cylindraceae, utrinque obtusatae, hyalinae, aseptatae, rectae vel curvulae, 72–76 × 5 μ. (Figs. 19–21.)

West Indies. Trinidad; on dead wood, *J. H. Hart.*

A fine well-marked species, allied to *Ophiobolus sarmenti*, Pass., but distinguished by the much longer ostiolum and erumpent perithecia.

Sordaria crustosa, *Massee.*

Perithecia densissime aggregato-confluentia, plagulas orbiculares 3–5 cm. longas atras efficientia, atra, glabra, contextu indistincto fuligineo opaco; ostiolo crassiusculo papillato. *Asci* cylindracei,

postice attenuato-pedicellati, octospori. *Sporae* ellipticae, atro-olivaceae, 25–28 × 14–15 μ, basi tantum appendiculo hyalino persistente 50 × 5–6 μ longo auctae. (Figs. 9–12.)

China. Szechuen; on dung of some herbivorous animal, *J. W. Brooke.*

A very distinct species, the closely crowded perithecia forming large orbicular crustose patches on dung. Allied to *Sordaria appendiculata*, Niessl., which differs in the villose perithecium, and the much shorter spore appendage.

Discomycetaceae.

Scleroderris gigaspora, *Massee.*

Ascomata gregaria, innato-superficialia, cylindraceo-turbinata vel e pressione mutua difformia, sessilia, extus sordide fusca, glabra, disco concavo 1 mm. diametro. *Asci* cylindracei, sursum obtusati, deorsum breve attenuato-stipitati, octospori, 250–280 × 22–25 μ, paraphysibus tenuibus apice ramosis hyalinis obvallati. *Sporae* vermiformes, rectae vel leniter flexuosae, multiseptatae, hyalinae, 150–160 × 7–8 μ. (Figs. 1–5.)

West Indies. Trinidad; occurring in clusters on scale insects—*Mytilaspis citricola*—on orange leaves, *J. H. Hart.*

Whether the *Scleroderris* is parasitic on the scale insects or not, can only be determined by experiments under circumstances where fungus and insect are available in a living condition, and in quantity. Allied to *Scleroderris seriata*, Rehm., and to *S. virescens*, Mass., but distinguished from both by the very much longer asci and spores, and by the habitat.

Uredinaceae.

Puccinia sclerolaenae, *Massee.*

Sori plus minusve dense gregarii, plerumque hypophylli, maculis lutescentibus insidentes, diu epidermide coriacea atque crassiuscula tecti, vix prominuli, atro-fuliginei, magnitudine ludentes. *Teleutosporae* oblongae seu ovato-subclavatae, medio parce constrictae, apice saepius plus vel minus apiculatae, pallide cinnamomeae, 40 × 30 μ; pedicello crassiusculo, 120 × 4 μ.

In iisdem soris teleutosporiferis adsunt uredosporae globosae, minutissimae, echinulatae, pallide fulvescentes, 15–18 μ diametro.

Australia. Queensland; on living leaves of *Sclerolaena biflora*, R. Br., *F. M. Bailey.*

Not closely allied to any known species. The teleutospore sori are variable in size and form, and are somewhat persistent, being protected by the coriaceous epidermis of the host.

Melanconiaceae.

Diplodia rapax, *Massee.*

Perithecia 3–7 aggregata, globosa, atra, primo tecta, dein erumpentia, rugulosa, glabra, 160–180 μ diametro, ostiolo minuto vix stromatis superficiem attingente donata. *Sporae* aerogenae, ellipticae, utrinque obtusae, medio 1-septatae, haud constrictae, opace fuligineae, 32–35 × 15–16 μ. (Figs. 13–14.)

Singapore. On living branches and roots of *Hevea brasiliensis*, Muell.-Arg., *H. N. Ridley*.

Tropical Africa. Gold Coast, Aburi; on living branches of *Hevea brasiliensis*, Muell.-Arg., *A. E. Evans*.

This fungus appears to be a true parasite on Para rubber trees. A curious and unexplained point is, that specimens were received at Kew for determination, almost at the same date, from Singapore and from the Gold Coast. It is just possible that the fungus has been conveyed along with the seed, as it is difficult to realise that the same species of fungus can have adapted itself to rubber trees in two distant countries, and within so short a period of time.

Mr. H. N. Ridley, F.R.S., has noted the occurrence of this fungus as a parasite on Para rubber cultivated in Perak (*Agric. Bull. Straits and Federated Malay States*, July, 1909).

Hendersonia microspora, *Massee*.

Perithecia dense gregaria, saepius plagulas majusculas formantia, erumpentia, globulosa, atra, ostiolo minutissimo vix papillato contextu indistincto donata. *Sporulae* elliptico-cylindraceae utrinque obtusatae, 3–5-septatae, fuligineae, 6–7 × 3·5 μ, sterigmatibus subconoideis suffultae.

West Indies. Trinidad; on dead or fading leaves of *Oncidium luridum*, Lindl., *J. H. Hart*.

Perithecia crowded and forming large patches on the leaf. Allied to *Hendersonia magnoliae*, Sacc.

Hyphomycetaceae.

Gloeosporium citri, *Massee*.

Maculae amphigenae, numerosissimae, minutae, primo fuscae dein albido-arescentes, postremo frustulatim deciduae ac folium perforatum relinquentes. *Acervuli* subcutanei, lenticulares, vix perspicui, 40–50 μ diametro. *Sporulae* cylindraceae, utrinque rotundato-clavatae, hyalinae, 14–17 × 5–6 μ, in cirrhos salmonicolores protrudentes.

West Indies. Trinidad; on fallen orange leaves, *J. H. Hart*.

This fungus occurred in abundance on orange leaves sent to Kew for the purpose of investigating a parasite attacking scale insects present on the leaves. All known species of *Gloeosporium* are parasites, and it is probable that in the present instance the *Gloeosporium* attacked the living leaves and brought about their early fall.

Septocylindrium suspectum, *Massee*.

Sporodochia amphigena, densiuscule sparsa, albida, aetate grisea, applanata, hyphae repentes, laxe ramosim intricatae, hic inde ramulos simplices erectos emittentes. *Conidia* cylindracea, 3–5-septata, breve catenulata, hyalina vel dilutissime roseo tincta, 35–45 × 5–6 μ.

West Indies. Trinidad; on the dead bodies of "Frog-hoppers" attached to leaves, twigs, &c., *F. Evans*.

This fungus is found in profusion on the bodies of dead "Frog-hoppers," and it is supposed that it occurs as a parasite, and might be utilised as a means of reducing the numbers of these destructive insects. Such a supposition, however, can only be confirmed or refuted by inoculation experiments conducted in those localities where host and supposed parasite occur in quantity.

Sterigmatocystis corolligena, *Massee.*

Hyphae steriles effusae, repentes; fertiles simplices, erectae, apice vesiculoso-inflatae, globosae. *Conidia* catenulata, basidiis verticillato-ramosis suffulta, globosa, flavida, verrucosa, 5–6 μ diametro, capitulum sulphureum formantia.

India. Manipur; growing on the corolla of a species of *Impatiens*, comm. *Sir J. D. Hooker.*

The present very interesting species was detected on the fleshy corolla of a species of *Impatiens* from Manipur, by Sir Joseph D. Hooker. In general structure and appearance it approaches most closely to *Sterigmatocystis sulphurea*, Fres., differing in the globose, warted conidia.

Hartiella, *Massee;* gen. nov.

Stroma teretiusculum, rigidum, erectum, apice capitate-conidiophorum, ex hyphis coalitis conflatum. *Conidia* in hypharum apicibus 1-septata, ellipsoidea, colorata, solitaria.

Differs from *Arthrosporium* and *Atractium* in the 1-septate conidia, and from *Symphyosira* in the conidia being solitary, and not concatenate.

Hartiella coccinea, *Massee.*

Stroma verticale, clavatum vel rarissime ramosum, coccineum, 1 mm. alt. *Conidia* ellipsoidea, 1-septata, glabra, coccinea, 7–9 × 4–5 μ.

West Indies. Trinidad; on shell of cacao pod, *J. H. Hart.*

This beautiful little fungus, when seen under a pocket-lens, suggests a sheaf of wheat. The colour throughout is bright red.

Macrosporium lanceolatum, *Massee.*

Acervuli epiphylli, nigro-olivacei, dense aggregati ac matricis superficiem totam velutino-puberulam efficientes; hyphae cylindraceae, erectae, flexuosae, deorsum atro-olivaceae, sursum sensim dilutiores, septatae, 80–120 × 7–8 μ. *Conidia* lanceolata, 5–7-septata, loculis centralibus 1–2 verticaliter septatis olivaceis, episporio crasso laevi donata, 60–70 × 14–17 μ.

Tropical Africa. Mozambique; on leaves of *Agave rigida*, Mill., *W. H. Johnson.*

A very distinct species, forming dusky-olive, minutely velvety patches on the leaves. The conidia are distinctly lanceolate, and the central cell alone is sparingly vertically septate. Allied to *Macrosporium concentricum*, Winter.

Description of Figures.

Fig. 1.—*Scleroderris gigaspora*, growing on *Mytilaspis citricola*, on an orange leaf. Nat. size.
„ 2.—Ascophores × 30.
„ 3.—Ascus containing 8 spores × 400.
„ 4.—Free spore × 400.
„ 5.—Fungus and scale insects on an orange branch. Nat. size.
„ 5*a*.—*Mytilaspis citricola*, × 20.
„ 6.—*Xylaria Pattersonii*. Ascophores. Nat. size.
„ 7.—Ascus containing spores × 400.

Fig. 8.—Free spores × 400.
„ 9.—*Sordaria crustosa*, on dung. Nat. size.
„ 10.—Perithecia × 40.
„ 11.—Ascus containing spores × 400.
„ 12.—Free spores × 400.
„ 13.—*Diplodia rapax*, on branch of *Hevea brasiliensis*. Nat. size.
„ 14.—Spores × 400.
„ 15.—*Marasmius scandens*. Nat. size.
„ 16.—Under surface of pileus × 20.
„ 17.—Upper surface of pileus × 20.
„ 18.—Spores × 400.
„ 19.—*Ophiobolus calathus*, × 100.
„ 20.—Ascus containing spores × 400.
„ 21.—Free spores × 400.

II.—FORESTRY NOTES.

W. Dallimore.

During the last week of November a tour was made through some of the wooded country in the north east of England, with the combined object of obtaining material for the Forestry Museum and observing the behaviour of various trees growing under forest conditions in different soils and at varying altitudes. The time was spent between 5 estates, viz., Raby Castle, Haydon Bridge, Alnwick Castle, Chatsworth and Wortley, whilst a visit was also paid to Rotherham, where notes were made on the condition of trees exposed to the adverse influence of smoke and other atmospheric impurities.

Before entering on a detailed description of the work done on the estates visited on this occasion, it may not be out of place to allude to certain general considerations and reflections induced by similar visits to localities in various parts of the country where trees are cultivated under forest conditions.

General condition of Plantations.—Broadly speaking, woods up to 20 years of age are found to be in good condition, but many older ones are suffering from over-thinning and over-aged trees. Owners, estate agents and foresters are enthusiastic over forestry matters, but much uphill work is necessary to counterbalance the effects of neglect and injudicious manipulation in bygone years.

Deteriorating Trees.—In many parts of the country well suited for the purpose, sentiment is allowed to interfere too much with practical forestry to admit of its being conducted on sound business principles. For instance, plantations are frequently found to be composed of trees which have arrived at, or passed, their prime, and which will never be of more value than they possess at the present moment; yet for more or less sentimental reasons these trees are allowed to remain year after year. From a practical point of view such plantations ought to be cut over by degrees, so

that after a resting period of 2 or 3 years, the land could be replanted and the next generation of trees grown. If these old trees are allowed to remain, say, for another 20 years, the timber will be worth no more at the end of that period than at the present time, and may be worth less on account of natural decay; whereas, if the value of the timber were realised and the cleared areas replanted, by the end of 20 years new plantations would be nearing the end of their unproductive stage. The eventual cost of clearing some old woods may be heavy, for there must be many trees that can be of little use except for firewood.

Undoubtedly there are many instances where plantations of old trees are essential for landscape effect, and where there are fine old park-grown specimens, whose value cannot be calculated in pounds, shillings and pence, which it would be rank vandalism to remove. These, however, are not now in question; it is to trees which are grown exclusively for timber that the present remarks are directed.

Over-thinned Woods.—Modern foresters are suffering rather severely for the sins of their forefathers, insomuch that a great number of woods, 40 to 80 years of age, have been over-thinned. Far too much head room has been allowed, with the result that the trees have developed branches at the expense of the trunks; therefore, the crop of timber over a given area is often less than half what it ought to have been. In some places an attempt is being made to rectify this by underplanting, but a long period has to elapse before the planter can see the beneficial results of his labour.

Young Woods.—By the appearance of the young woods one can appreciate the work that is being done, for in the majority of instances these are in a highly creditable condition. Young plantations generally, whether in poor or in better class ground, are making satisfactory progress and considerable care is being exercised as regards thinning and general upkeep. In some instances diseases of various kinds are apparent, but these are receiving what practical attention is possible.

The kinds of trees planted on a large scale are surprisingly few, the chief being larch, common and Japanese; Scots pine; Corsican and Austrian pine; spruce; oak; beech; birch and sycamore, with a little ash and poplar. Very little Douglas fir has been noted and no large plantation has been seen.

In most cases mixed plantations are preferred to pure woods though the latter may occasionally be noticed. The value of a little shelter is apparent in the case of young trees everywhere. A natural depression in the ground, a clump of old trees, or even a low hedge results in the trees in the vicinity being more vigorous than those which are less favoured.

Whilst inspecting various plantations the thought has occurred that a great deal of valuable experimental work might be carried on at a small expense, with the co-operation of landowners, by distributing young trees of various kinds, not at present grown for timber in Britain, which are known to produce valuable timber and would be likely to thrive. These, planted in mixed woods, in different parts of an estate, could be easily compared with trees which produce less valuable timber but are known to grow well, and in a few years'

time a decision could be arrived at as to the prospects of different trees in different neighbourhoods. This sort of thing is being done with Douglas fir on one or two estates.

Estate Nurseries.—Estate nurseries are receiving attention almost everywhere, and foresters are enthusiastic over their nursery grounds. The general conclusion is that a nursery in connection with estate forestry is a valuable asset, for, in addition to its being more economical to grow young trees rather than purchase them large enough to put out, more satisfactory results are obtained from trees grown on the place than from those received from a distance. The conclusion is possibly just, for not only are the trees grown under the same climatic conditions from babyhood, but when planting, it is only necessary to lift sufficient at one time for a single day's planting, no long railway journey is necessary and the laying in of many thousands of young trees is dispensed with. In some cases the young trees are raised from seed sown on the estate, but more frequently one year old seedlings are purchased. These are planted in nursery rows and taken to permanent positions when from 3 to 4 years of age.

Sale of Timber.—It is difficult to form anything like a correct idea of the average value of the different kinds of timber, since so much depends on quality and distance from railway or town. Occasionally a local demand occurs for some special kind of wood and a good price is obtained, whilst, only 50 miles away, little more than firewood price has been obtained for the same kind of timber. Undoubtedly, were the supply of timber regular prices would be better; as it is, fellings are often irregular, and one year the local market may be flooded, whilst for several years afterwards no timber is cut. Owing to this, there is no encouragement for timber merchants to erect plant for dealing with large quantities of timber in a particular neighbourhood, and it has to be sent a long distance to a market, a circumstance which has a decidedly adverse influence on the price. Larch usually sells well and from tenpence to one shilling and twopence a cubic foot is obtained standing. Scots pine on the other hand may fetch eightpence a cubic foot if of good quality, whilst in an out-of-the-way place it has been sold for twopence half-penny. On one estate a small plantation of black poplar about 60 years old was disposed of recently at ninepence a cubic foot after deducting cost of delivery at the local station 2½ miles distant. Oak appears to fluctuate considerably, some being down as low as one shilling while from other plantations it is sold at double the price. As a rule timber is sold standing and the buyer sees to the cutting and removal.

Timber for estate purposes frequently forms a large item, and each estate usually runs its own saw mill and creosoting plant.

Sport and Forestry.—The rearing of game, shooting, and to some extent hunting, deserve serious consideration in connection with forestry. On most estates gamekeeping and forestry are run together, therefore the forester has to arrange his work so that there is no serious disturbance of game. This may handicap him rather considerably, for he may be precluded from work in certain woods during several of the most useful months of the year, *e.g.*, from

September until shooting parties are over, which may not be until about the end of January. Moreover, gamekeepers must have the run of the woods, and, in the event of undergrowth being scarce, branches of Scots pine and other evergreens may have to be introduced from other places and stuck in the ground. As a result of this, branches brought from disease-infected trees have sometimes started an epidemic in what was previously a clean plantation. In some cases it has been noticed that some of the poorer trees had been partly chopped through and broken over so as to lie on the ground. Such a proceeding may be advantageous from the gamekeeper's point of view ; it certainly is not so from that of the forester. The rearing of pheasants, however, causes but slight annoyance as compared with the damage done by hares and rabbits.

Hares and rabbits are responsible for considerable damage by the wholesale nibbling of the bark of young trees. Some plantations have been observed where almost every beech and oak had been nibbled, and it appears that it has been necessary to plant some woods three times over on this account. Many of the younger plantations are protected by wire netting. This, however, is an expensive item, and adds considerably to the upkeep of woodlands. The system of debiting the game department with the cost of wire netting has been introduced on some estates ; this appears to be a proper step to take, since but for the game, wire netting would not be required. Acting on strictly business principles, the game department ought to be debited with the loss caused by nibbled trees, extra labour, and introduced insect pests.

Damage caused by hunting is usually due to thoughtlessness. In the excitement of a hot chase young plantations sometimes suffer, whilst cases are known where a huntsman and his pack of hounds have quartered themselves as calmly in a two-year-old plantation as they would have done on a meadow.

Labour.—As a rule the work on an estate is carried on by regular hands. Ordinary woodmen are drawn from the neighbourhood ; head foresters and foremen from other parts of the country. A few young foresters move about from estate to estate to gain experience, and these are the men who usually obtain situations in after life as head foresters. If extra labour be required for planting, men are preferred who have led an agricultural life, that is to say, men who have small farms in the vicinity, and their sons, or agricultural labourers. The older foresters have very decided views with regard to the training of young foresters. They maintain that a sound practical training is essential but not sufficient, and that a certain amount of theoretical knowledge, with some idea of general estate management, is desirable. On this account some foresters give those under them theoretical instruction, lessons on book-keeping and other subjects, while those in the vicinity of Newcastle endeavour to get their men to take the forestry course of lectures given at the Armstrong College in that city.

Visit to Rotherham.—Nov. 24.

Rotherham is typical of towns engaged in the iron and coal industry and the atmosphere is perpetually charged with smoke and other impurities which exercise a disastrous effect on tree life. In

the immediate vicinity of collieries, coke ovens, steel works and live spoil heaps it would be difficult to imagine worse conditions, whilst half-a-mile away, circumstances are little better. Even at a distance of from one to two miles from some of these places, the enervating effects are noticeable, especially in connection with old trees, and scores of dead and dying trees are to be seen. In one case a small plantation was pointed out where quite one-third of the trees had died within the last 7 years. Young trees also suffer as may be noticed by enfeebled growth and weak buds. Horse chestnut and beech appear to be particularly hardly hit whilst conifers are impossible. The young trees which appear to stand the greatest chance are sycamore, plane, ash, elm, and sweet chestnut.

Raby Castle Estate.—Nov. 25.

Raby Castle, the Durham residence of Lord Barnard, is situated in the village of Staindrop, 2¼ miles distant from Winston Station, which is reached from Darlington. Between Winston and Staindrop the attention is drawn to the use made of the common thorn as a hedge-row tree, for that and the ash appear to be used almost exclusively for the purpose. The majority of the thorns are well developed examples with trunks 6 to 10 feet high with an average circumference of between 3 and 4 feet. On arrival at the estate office, Lord Barnard's agent, Mr. Fife, placed me under the guidance of the head forester Mr. Bewick, and I was shown as much of the home woods as the time at my disposal would allow. The woods and plantations extend over an area of about 2,200 acres and are principally situated on land of fairly good quality. They are nowhere more than a few hundred feet above sea level but in another part of the county, about Teesdale, Lord Barnard has established plantations at an altitude of between 1,000 and 1,200 feet which are said to be giving satisfactory results.

Lord Barnard is keenly interested in forestry and pays much direct attention to the work. Everything is conducted on strictly business principles, and strict accounts are kept of expenditure and income.

The trees most in evidence in old and young woods are larch, oak, beech, Scots pine (used in young woods extensively as a nurse) and birch. Ash, which is so frequently used in the neighbourhood in hedge-rows, is scarce in the woods. In one place poplar has been grown with advantage, whilst some good sweet chestnuts were noted in the park.

The older woods have been over-thinned at some period, but contain a lot of very good timber. A very nice oak plantation was noted in which the trees were from 50 to 70 feet high with a girth of from 50 to 70 inches. Good plantations were also noticed of spruce, beech, birch and a mixture of oak, larch, beech and other trees. A rotation system of felling and planting has been adopted within the last few years and from 120,000 to 130,000 young trees are planted annually. About half of these are drawn from the estate nursery and the remainder are purchased. Plantations from one year old to fifteen were noted and, taken all through, growth was satisfactory. As a rule little growth is apparent during the

first year, but when established, leads 18 inches in length are common. Spruce appears to suffer rather badly the first year or two after being put out but eventually recovers and grows rapidly. A few Douglas fir were seen here and there. Mr. Bewick is of opinion, however, that this tree will thrive best as a pure wood.

In all new plantations corners are being left for game cover and in those corners everything will be sacrificed for the sake of cover. The rides are so arranged that they lead to these parts, so that during shooting operations, the guns may be stationed in the rides about the covers, the game being driven to those particular places. It is considered that this will be an advantage to both the woods and the game keepers.

As it is a hunting country provision has been made for keeping horsemen off the young trees by marking out the rides with stakes from 6 to 8 feet in height. One young plantation I passed through had a rank undergrowth of broom and gorse. This, I was informed, sprang up naturally after an oak wood about 200 years old had been felled and the idea is that the seed had been in the ground and lain dormant until the soil was disturbed. At any rate there is no other broom or gorse in the immediate neighbourhood. How long broom and gorse had been absent from the wood was not known.

Larch disease is rather prevalent and larch aphis is found in most of the young plantations. For this reason the proportion of larch to other trees planted has been reduced about one-half. Some of the older larch about the estate show that they have been diseased in their younger days but appear to have grown out of it now. That larch thrives in the neighbourhood is clear from the numerous fine examples to be seen. One specimen noted is about 115 feet high, with a girth of 9 feet 6 inches at 4 feet above the ground. This has been calculated to contain from 240 to 250 feet of timber and to be worth about £15. An outlying plantation, formed principally of Scots pine, was badly attacked, a few years ago, by the pine saw-fly. This has been practically cured by hand picking during the larval stage, though it took several years to accomplish.

Fine individual trees of oak, beech, spruce, silver fir and sweet chestnut were noted.

Haydon Bridge.—Nov. 26.

A visit was paid to Haydon Bridge, which is situated about midway between Newcastle and Carlisle, for the purpose of meeting Mr. E. Davidson, the Secretary of the Royal English Arboricultural Society. Mr. Davidson manages several estates in the neighbourhood and in his company I visited the woods belonging to Mr. J. E. Rogerson. The principal young woods stand in very exposed positions at an altitude of between 500 and 600 feet, and are composed mainly of Scots pine. Haydon wood was planted about 30 years ago and is about 7 acres in extent. The trees are from 40 to 45 feet high and of 10 consecutive trees the girths were 42, 31, 38, 30, 20, 32, 31, 25, 21, and 34 inches respectively. The wood has, however, been rather over-thinned and the trees

are inclined to develop too large heads. Several younger woods were visited in which Scots pine formed the dominant feature. Some of these were on poor, heather-covered land but the trees were vigorous and the past season's growths were from 12 to 18 inches in length. In the neighbourhood some very fine spruce may be seen.

Alnwick Castle Estate.—Nov. 27.

The Alnwick Castle estate of the Duke of Northumberland forms the business centre of His Grace's Northumbrian property. I there met Mr. Gillanders, the head forester, who gave me an idea of the forestry carried on in different parts of the county. Between 5,000 and 6,000 acres are given over to woodland, and upwards of a quarter-of-a-million young trees are planted annually. Eight nurseries have been established in different parts of the county, two of the principal ones being at Alnwick. These were stocked with young trees, from seedling size to those ready for permanent planting. Seedlings of many kinds are raised on the place, and good seed-beds of various kinds of seedlings were noted. Experiments are being carried on with *Pinus montana*, *P. montana uncinata*, and *Picea alba*, as shelter trees and bushes in exposed situations; it is as yet too early, however, to determine their value as compared with other species.

In the neighbourhood of Alnwick trees generally thrive well, and very fine examples were noted in the park and dairy ground of beech, Douglas fir, silver fir, elm, oak and other trees. The altitude in that particular district does not exceed 200 feet, but in other parts of the county, plantations have been formed up to 1,200 feet, with, I was told, satisfactory results. At the higher stations, and in the more out-of-the-way places, Scots pine is the principal tree grown, and as much as possible of the timber is cut up on the spot by means of a portable saw mill, whilst on the lower lands and in more accessible places, trees which produce better quality timber are planted so that they may be removed bodily by road, rail, or water, to the nearest market.

A regular system of felling and planting has been adopted, and in one direction or another, work, directly or indirectly connected with forestry, is found for a large number of men. Near the forester's house there is a very fine saw mill, which is capable of turning out an enormous quantity of work, and a capital creosoting plant, the motive power for the two being supplied by an ordinary traction engine. The creosoting tank is in the form of a long cylinder, one end of which can be removed. The bottom is fitted with rails connected with the timber yard, so that loaded trucks of material may be easily run into the tank, and as easily removed when the work is accomplished. When full, the end is placed in position and secured. The cylinder is then filled with creosote, which is heated, pressure is applied to inject the creosote and the timber is ready for removal in from 3 to 4 hours in most instances. A machine is also employed for working up small wood, branches and first thinnings from plantations, into serviceable fencing. The pieces of wood are connected by two or more rows of strong wire,

which is well twisted between each two uprights. The wood is all creosoted, and what would otherwise be valueless except for firewood, is turned into a capital, light, portable fence.

Mr. Gillanders is greatly interested in entomology, and most of his spare time is connected with this hobby. After 20 years study of forest insect life, he has lately presented the substance of his observations to foresters at large in the form of a book entitled "Forest Entomology."

The time at my disposal was too short to allow me to visit the various plantations in the neighbourhood, they are, however, composed chiefly of larch, beech, oak, Scots pine, sycamore and birch.

Chatsworth.—Nov. 29.

A great deal of planting has been done on the Derbyshire estate of the Duke of Devonshire, within the last 20 years, especially in the vicinity of Chatsworth. The land generally appears to be of poorer quality than that seen further north, yet, that it is good enough to grow good trees on is shown by the many fine specimens seen about the park, and the vigorous growth made by trees in young plantations. About the Derbyshire hills and moorlands there appears to be a wide area suitable for forest land, which, at the present time, affords but scanty pasture for sheep. In the neighbourhood all sorts of altitudes up to 1,200 feet may be found, and a fairly wide selection of trees might be grown. The district, however, is a cold one, and I am informed that frost is frequently experienced during every month of the year. Spring is a trying time for the larch about Chatsworth, and the first growth is frequently crippled by cold, yet many young plantations are making satisfactory progress. The trees planted most largely are Scots pine, oak, beech, birch, larch and spruce. Mr. Robertson, the head forester, has experimented all over the estate with Douglas fir, but in no instance has he had results which warranted his carrying on the cultivation beyond the experimental stage.

In this particular part of Derbyshire, the fields in most cases are divided by stone walls instead of hedges, and where a field has been taken over in an exposed position for plantation work, surrounded by a wall, the shelter afforded has made a wonderful difference to growth, whilst the greater proportion of vigorous hard-wood trees in such plantations, shows that they are hare and rabbit proof. The value of such walls as a fire-break was apparent in one plantation which had, through some mishap, been set on fire. The fire had worked through the whole plantation, and was only checked from spreading over a larger area by the wall. As an instance of planting on rough ground, a plantation was noted on what was apparently the site of an old quarry, and there were scarcely half-a-dozen consecutive yards of level ground in the whole area, whilst large and small stones cropped up everywhere. From this ground, however, one crop of trees has already been taken, and another crop is established. Several patches in young plantations were noticed where the root-rot fungus, *Armillaria mellea*, had carried off numerous trees. Scots pine appears to be the worst sufferer.

Mr. Robertson takes a keen interest in all that affects forestry and foresters, and in addition to giving his own men practical training, he has instituted a course of technical lectures, which are attended by his own men and by men from neighbouring estates.

Wortley Hall.—Nov. 30.

Wortley Hall, the property of Lord Wharncliffe, forms the business centre of the Wharncliffe estate, and is easily reached from Sheffield. For a distance of 3 or 4 miles the railway passes through the largest wood, known as Wharncliffe wood, 1,200 acres in extent, and it is easy to see that if woods are to be planted in the vicinity of railways, precautions will have to be taken to guard against fire, for this wood has suffered very severely, and large areas have been destroyed. The most disastrous time for fires in that neighbourhood is said to be early spring.

The woods on this estate are under the superintendence of Mr. Goldring, of Kew, and a considerable amount of planting has been done during the last 22 years. Mr. Broughton, the estate agent, took me round the majority of the younger woods, and very good plantations were seen of Japanese larch, Corsican pine, and mixed trees. A plantation of Japanese larch on the site of an old nursery is very vigorous, and another good plantation mixed with pine was seen in an exposed place at an altitude of 800 feet. In the last-named plantation, the soil is of a clayey character overlying rock 18 inches below. Young plantations, 2 to 4 years old, of mixed trees, were noted which were making remarkable progress. Previous to planting, the ground was well worked by a steam plough. Plants $1\frac{1}{2}$ feet high were inserted, and many which have been planted 4 years are now upwards of 10 feet in height. Last season's growth in numerous instances measured $2\frac{1}{2}$ feet in length. It is only fair to add, however, that the best plantations are well sheltered. In another place a larch plantation, 3 years planted, averaged between 8 and 9 feet in height.

It is estimated that 1,000,000 Corsican and Austrian pines have been planted about the estate, one large wood, known as the Jubilee plantation, being composed almost entirely of these trees. This plantation varies in altitude from 300 to 600 feet, and is on sandy loam, overlying clay. The trees averaged 4,000 to the acre at planting time, 1887, and are now about 35 feet high with an average diameter of $6\frac{1}{2}$ inches at 3 feet from the ground. An isolated tree was seen in another position which is about 50 years of age and 60 feet high. This tree, I was informed, is adding girth at the rate of $\frac{3}{4}$ of an inch a year. When these pines were first planted, it was with the idea that the thinnings could be disposed of locally for pit props, but owing to rapid growth, the wood lacks the necessary strength. For landscape effect pure woods of these pines have too sombre an aspect, and the introduction of lighter coloured foliage here and there would be an improvement. The natural tree of the neighbourhood is sycamore. This seeds freely and grows rapidly, and a local market is found for the wood. About the park there are many fine old trees, and in the pleasure grounds a fine old oak was seen which girthed 21 feet 3 inches at 4 feet from the ground.

Several colliery spoil heaps in the neighbourhood are being clothed with *Caragana arborescens*, *Colutea arborescens*, *Rosa rubrifolia*, common broom and other things, whilst in two places young plantations of the true cricket-bat willow were noted.

In conclusion, I should like to express my gratitude for the kindness shown by all with whom I came in contact during the tour.

III.—ON THE GROWTH OF ULVA LATISSIMA, L. IN WATER POLLUTED BY SEWAGE.

A. D. Cotton.

It is well-known that the marine alga *Ulva latissima*, L. thrives in brackish water and in localities where fresh water runs into the sea. At the mouths of rivers and on muddy shores of estuaries it frequently occurs in great quantities, forming a broad belt extending for several miles. Its growth under these conditions is sometimes remarkably luxuriant, fronds of enormous size being produced. In stormy weather, especially during summer and autumn, much of the *Ulva* is detached and washed ashore. This mass of vegetable matter if not taken out to sea by succeeding tides, speedily decays and gives rise to a most objectionable smell, sulphuretted hydrogen being liberated. In the neighbourhood of several seaside towns the smell amounts to a nuisance and the authorities have annually to take steps to remove the masses of decaying seaweed. Occasionally the trouble is so severe that in spite of all efforts the stench is almost intolerable. In these cases not only is the health of the population affected, but property in the vicinity is depreciated. It is not surprising therefore, that though the *Ulva* is quite unobjectionable whilst growing, enquiries should be made as to the best method for its eradication.

Although the fact that *Ulva latissima* flourishes in brackish water has long been familiar to botanists, it has only comparatively recently been shown that its occurrence in quantity is associated with the pollution of seawater by sewage. The subject has been specially investigated by Professor Letts, and his results show that in polluted water *Ulva* grows in remarkable luxuriance. That it flourishes and sometimes grows to a large size in water which though brackish is comparatively pure is not denied ; but its excessive growth in large quantities appears to be confined to sewage-polluted districts.

The decay of the *Ulva* has also been studied to some extent by Letts, but the subject requires further investigation. It is probable that at least two species of bacteria are concerned. The products of the fermentation induced by the first micro-organism are fatty acids, carbonic anhydride, and hydrogen ; and it is believed that this organism attacks the albuminoids of the seaweed. The fermenting *Ulva* is later attacked by another species with the subsequent production of ferrous sulphide and sulphuretted hydrogen. These sulphur compounds are probably produced from the sulphates of the sea-water and not from the albuminoids of the alga.

The methods for suppressing the growth of *Ulva* may be grouped under three heads. An obvious and effective method in certain localities is to reclaim the land. This, however, is not always practicable. Two other courses are open, namely :—to poison the plant by the application of chemical substances ; or, to hold its growth in check by the regulation of local conditions based on a knowledge of its ecology. The chemical treatment even when easy of application requires to be exercised with caution on account of the danger to fish. It is a subject receiving attention from chemists and need not be further alluded to here. The last of the three methods opens up a very large and interesting field of enquiry, and one which will also probably yield results of considerable service in the solution of the *Ulva* difficulty.

The magnitude of the nuisance appears to warrant a thorough study of *Ulva latissima*. This should embrace not only cultures in the laboratory and in the open with regard to its nutrition, but an investigation of its natural growth along an extended area of the coast, noting carefully the external conditions under which *Ulva* is found to flourish. The coast selected should possess a variety of physical features, and if possible mud-flats unpolluted by sewage, for the purpose of comparison with estuarine conditions.

It may be assumed that impurities in the water materially affect the marine flora at the mouth of a river. The *Ulva* problem has been investigated by Letts from this point of view, and as might be expected many interesting facts have been brought to light. Among these may be mentioned the high proportion of nitrogen in the tissues of *Ulva* grown in polluted water, and, on the part of this plant an extraordinary power to assimilate ammonia and nitrates. In addition, however, to a chemical investigation of the subject, other questions have to be taken into consideration, such as the life-history of the plant itself, the nature of the substratum, the liability to desiccation and the movements of water due either to currents or wave-action.

Kew is more immediately concerned with the botanical aspect of the question, and in order to learn further details of the life-history and biology of *Ulva* a few days were spent by the writer at Southampton and Weymouth in November. Attention was also paid to the effect of currents. The season was somewhat late for the purpose but interesting data were obtained.

Two rivers flow into Southampton Water. The Test at the north-west corner which passes through some small towns and villages ; the Itchen on the east side into which practically all the sewage-effluent of Southampton and Eastleigh is discharged, and which therefore may be regarded as being badly polluted. The peculiar double tides in the locality probably do not aid the escape of the river water. Near the town of Southampton there are at times considerable accumulations of *Ulva*, which in warm weather putrefy and emit offensive smells. The statement by one of the residents, that the white paint of boats is blackened in a night, is in accord with observations in other places and shows that the air becomes heavily charged with sulphuretted hydrogen.

At the time of the visit a strong north-east wind prevailed which, together with the spring tides, had cleared the shore of most of the

weed that had been cast up by the autumn gales. On the west side of Southampton Water opposite the town, loose floating *Ulva* was found in abundance. In certain spots a sward of *Ulva* existed which was largely composed of small plants attached to stones by a basal disk. Among these were others attached to mussels, being firmly held together and to the mussels by the byssus of the latter. On the grass above high-water line dried *Ulva* fronds were found everywhere in profusion, having been blown ashore by the wind. This part of the Test estuary appeared too wide and too exposed to conduct investigations on the effect of currents.

A comparison was made of the algal flora at the mouth of the Test (near Redbridge) with that of the Itchen, and a considerable difference was found to exist. Records of the marine flora of these two rivers kept throughout the year, and extending over several seasons would be of much interest. It would indeed be advisable for a number of rivers to be investigated in this way with a view to obtaining a knowledge of the species characteristic of purely brackish water, and those which indicate moderate or strong sewage pollution. For preliminary work such data would form a useful index to determine roughly the amount of pollution of a given stream. Much has been done on the microscopic flora of large rivers in connection with their self-purification by micro-organisms, but apparently little or nothing of a similar nature has been accomplished with the marine algae which occur at the mouths of such rivers.

Passing now to Weymouth, the flora of the Backwater of this town afforded an interesting and profitable study. The writer was much indebted to Dr. W. B. Barclay, the Medical Officer of Health, for his kindness in giving valuable local information, and in affording facilities for work. The upper part of the Backwater (usually called the Lake) receives at its northern end the Wey, a river slightly polluted by crude sewage from a few small villages. At the other end it communicates with the harbour. The whole Backwater is tidal, but the water is impounded at the harbour end by a dam. The dam is placed just below the level of high water at neap tides, so that the tide flows daily into the lake over the dam. The gate of the dam is opened at regular intervals to cleanse the lake thoroughly. *Ulva latissima* has always been present in great quantity in this sheet of water, and unpleasant odours have existed at intervals for at least 30 years. Quite recently, however, a decided increase in growth has been noted, and this appears to be correlated with an alteration in the topography of the lake. Three years ago, in connection with railway improvements, a bridge was formed across the Backwater connected on either side by stone embankments. This has had the effect of deflecting what little current existed to the middle of the lake and forming on the eastern side a bay of quiet shallow water. During the last two seasons the increase of *Ulva*-growth in this bay has been very marked, and in the opinion of several of the residents it is connected with the loss of current. If this be correct it confirms what has previously been suspected, that tranquillity of water is specially important in favouring the growth of *Ulva*. The amount of weed that is actually

attached to the bottom in the bay in question requires, however, investigation. For many years the corporation have had men at work removing the *Ulva* throughout the summer and autumn months (in 1909, June to November). The weed is collected by means of wooden rakes and is carted on to the land as manure.

In noting the ecological conditions of this lake which supports such a luxuriant *Ulva*-growth, the following are the most marked features :—(1) the feeble salinity of the water ; (2) the presence of a certain amount of sewage pollution (besides the Wey a storm-over-flow containing sewage also flows into the lake) ; (3) tranquil surroundings, breakers being entirely absent, and the water being little disturbed by currents, and ; (4) the presence in the muddy bottom of stones and mussels to which the young plants are attached. The first two factors lend themselves to experimental investigation in artificial cultures. The work could be conveniently carried out at a marine biological station, and in such laboratories pumping facilities are at hand for studying the effect of flowing *versus* stagnant water. The presence of a firm anchorage raises the question of the germination of the spores and vegetative reproduction. It is well known that almost any part torn from an *Ulva* frond will grow readily, and that fronds may be kept alive in aquaria for 2 years or longer. The length of time that the young *Ulva* plant remains attached by its own disc, and the method of propagation in these vast beds has not yet been studied in detail. Kylin remarks that he has never observed the large floating fronds in a fruiting condition. Schiller, commenting on the quantity of loose *Ulva* near Triest, states that it is always sterile.

In being able to flourish in stagnant and polluted water *Ulva latissima* is unlike other marine algae. Quiet water is usually poor in species and localities contaminated by sewage are always avoided by the algologist. Most marine algae prefer turbulent conditions, or situations where a vigorous current or tide ensures thorough aeration and constant renewal of the necessary salts.

The remarkable power possessed by *Ulva* for assimilating nitrogenous compounds, may possibly explain its excessive growth in contaminated water. The supply of oxygen, which in such water is exceedingly poor, is possibly derived from that evolved from the plant itself. The intake of ammonia and nitrates would stimulate growth and hence also the assimilation of carbon dioxide, and this in turn would be attended by a corresponding liberation of oxygen which in quiet water would not be swept away but be available for respiration by the plants. Letts has pointed out that *Ulva* may be regarded as an instrument designed by nature for the final purification of polluted sea water. Bacteria first convert the nitrogen of the albuminoids and other organic compounds into ammonia and nitrates, the *Ulva* follows absorbing these substances and using the carbon dioxide which has also been supplied in abundance by the action of micro-organisms, the final result being the oxygenation of the water. This suggests an enquiry as to why it is that other algae cannot flourish under similar conditions. Many species are very sensitive to a lack of the normal amount of sodium chloride, and it is probable that they are equally susceptible to the presence of impurities. It would be of special interest to

earn something of the effect of ammonia and nitrates on other algae, and what power they possess of absorbing these substances.

As has been shown above, the presence of a vigorous growth of green algae in polluted water must be regarded as beneficial on account of the evolution of oxygen due to the process of photosynthesis. On the other hand, the growth of *Ulva* in the neighbourhood of towns sometimes become so excessive that the nuisance on decay is exceedingly serious. The *Ulva*-enquiry is therefore of considerable economic importance, but in addition to this it is of very great interest from a purely scientific standpoint. The questions raised concern the chemist, the bacteriologist, and the botanist, and it is only by intimate co-operation that the subject can be successfully investigated.

IV.—DECADES KEWENSES

Plantarum Novarum in Herbario Horti Regii Conservatarum.

DECAS LV.

541. **Aconitum Forrestii**, *Stapf* [Ranunculaceae]; *A. Souliei*, Fin. et Gagn., comparabile, sed caule terete, foliis brevissime petiolatis, panicula multo majore ramis inferioribus longis ramulosis oblique erectis, pedicellis longis, galeae curvatura inferiore (marginibus) perconcava, nectarii ungue glabro, cuculla longiore, carpellis glabris, stylo longo distinctum.

Tubera ignota. *Caulis* fere 1 m. altus, a medio ramosus, erectus, strictus, teres, pilis recurvis minute pubescens et superne insuper patule hirsutus. *Folia* numerosa, in parte intermedia congesta, basalia ignota; petioli subnulli vel superiores ad 5 mm. longi; laminae inferiores et intermediae utrinque glabrae, superiores inferne ad margines et infra in nervis, summi etiam supra magis minusve hirsutae, ambitu late orbiculari-ovatae, basi subtruncatae, ad 8 cm. longae et latae, ad $\frac{3}{4}$ tripartitae, segmento intermedio rhomboideo-cuneato vel sublanceolato ad 6·5 cm. longo ad 4 cm. lato, 3-lobo lobis crenato-serratis crenis latiusculis apiculatis vel acutis, segmentis lateralibus oblique ovatis inaequaliter bilobis caeterum intermedio similibus; folia summa minora et minus vel vix divisa. *Inflorescentiae* paniculatae, laxae, ubique dense patule pilosae, ramis inferioribus longis foliatis oblique erectis ramulosis; bracteae superiores lanceolatae, utrinque dente 1–2 magno triangulari instructae, inferiores in folia abeuntes; bracteolae lanceolato-lineares vel lineares; pedicelli sub anthesi 3–4 cm. longi, demum magis elongati. *Sepala* coerulea; summum galeatum pilosum, 2 cm. altum, a basi ad apicem 1·5 cm. metiens, curvatura superiore fere semicirculari inferiore perconcava, acute rostratum rostro deflexo; sepala lateralia late suboblique obovata, circiter 1·8 cm. longa, inferiora oblique anguste oblonga, circiter 1·5 cm. longa, paulo descendentia. *Nectaria* ungue gracili superne prorsus curvato glabro 1·5 cm. longo, cuculla ovata 7 mm. longa apice obtusissima et in dorso gibbosa, labio latiusculo brevi subintegro parce pilosulo.

Filamenta circiter 9 mm. longa, ultra medium anguste alata, glabra. *Carpella* 5, oblique erecta, anguste oblonga, glabra vel subglabra, sub anthesi 4 mm. longa, stylo filiformi 3·4 mm. longo. *Fructus* maturus ignotus.

China. North-west Yunnan, *Forrest.*

542. Aconitum stylosum, *Stapf* [Ranunculaceae]; *A. spicato*, Stapf, imprimis formae laxae, simile, sed foliis magis dissectis, inflorescentia foliata et stylis quam carpellis sub anthesi conspicue longioribus distinctum.

Tubera imperfecta nota. *Caulis* robustus, ultra 60 cm. altus, pilis recurvis minute pubescens, inferne demum glabratus et nitidus. *Folia* infima 5–6 approximata, sub anthesi emortua, intermedia circa 6–8 dissita, longe petiolata, superiora paniculae ramos vel flores subtendentia multo brevius petiolata; petioli intermedii ad 11 cm. longi, superiores 4–1 cm. longi, illi demum glabrati, caeteri imprimis supra pubescentes: laminae praeter margines et nervos supra parce vel parcissime minuteque pubescentes, glabrae, ambitu cordato-orbiculares vel superiores cordato-ovatae, sinu lato vel (superiores) angusto, ad $\frac{1}{5}^{4}$–$\frac{1}{2}^{1}$ 3-partitae, segmento intermedio rhomboideo basi late cuneato 7–5 cm. longo 5·5–4·5 lato, lateralibus trapezoideis 6–3 cm. longis profunde inaequaliter 2-partitis omnibus profunde laciniatis laciniis dentato-lacinulatis lacinulis vel dentibus apiculatis. *Inflorescentia* erecta, ad 20 cm. longa, subpaniculata, laxiuscula, griseo-pubescens, foliata, ramis infimis 1–2 paucifloris uti pedicellis flexuoso-patulis, his 6–1 cm. longis; bracteae omnes praeter summas folia minora referentes, quam pedicelli longiores; bracteolae pedicellorum inferiorum foliosae, laciniato-dentatae, ad 2 cm. longae, superiorum lineares, integrae, 4–2 mm. longae. *Sepala* coeruleo-violacea (?); summum galeatum, subglabrum, oblique semi-orbiculare (a latere visum), 1·8–2·1 cm. altum, 1·7–2·4 cm. a basi ad apicem rostri brevis acuti metiens, 9–10 mm. latum, ungue brevi lato; lateralia ex ungue brevi lato oblique orbicularia, circiter 1·8 cm. longa, 1·4–1·5 cm. lata, intus hispida; inferiora late oblonga, 1·5 cm. longa. *Nectaria* magis minusve hispida, ungue curvato elongato-sigmatoideo ad 1·5 cm. longo, cuculla oblonga 6 mm. longa apice in dorso gibbosa, labio fere aequilongo emarginato. *Filamenta* parte alata lata 8–9 mm. longa, subito contracta, glabra. *Carpella* 5, late oblonga, laxe sericeo-tomentosa, sub anthesi 4–5 mm, longa, post anthesin subdivergentia, stylo filiformi gracili 6–7 mm. longo. *Fructus* ignotus.

China. North-west Yunnan, Cheku (Tsekou), *Th. Manberg.* There is only a fragment of the mother tuber attached to one of the specimens. From this it would appear that the tubers are fairly large. The taste is slightly sweet and is followed by a strong tingling sensation.

543. Desmodium longipes, *Craib* [Leguminosae-Hedysareae]; species e grege *Phyllodiorum*, a *D. pulchello*, Benth., bracteis multo majoribus, a *D. vestito*, Benth., et *D. grandi*, Kurz, foliorum petiolis brevissimis distincta.

Suffrutex 1·5 m. altus (*fide Kerr*). *Rami* florigeri flexuosi, striati, villosi, teretes, superne ramosi vel simplices, circiter 2·5 mm. diametro. *Folia* pinnatim trifoliolata, 20 cm. longa; stipulae

subulato-filiformes, 1·4 cm. longae, basi 2 mm. latae, striatae, villosae ; petiolus circiter 4 mm. longus. *Foliola* petiolulata, supra tenuiter pilosa et scabridula, subtus pilosa, chartacea, nervis cum nervulis supra conspicuis subtus prominentibus, apice acuta mucronata, basi rotundata, margine integro ciliato ; lateralia oblique ovata, circiter 3·5 cm. longa, 2·25 cm. lata, nervis lateralibus 7–8-jugis ; terminale oblongo-lanceolatum, 15–17 cm. longum, 5·5 cm. latum, nervis lateralibus 13-jugis ; stipellae filiformes, 2–4 mm. longae. *Racemi* terminales, usque ad 36 cm. longi ; bracteae foliis similes nisi foliolo terminali defecto, petiolo in aristam 1·5 cm. longam producto, et foliolis apice rotundatis vel emarginatis. *Umbellae* densae, multiflorae ; pedicelli breves, calycem vix aequantes, pubescentes. *Calyx* campanulatus, 4 mm. longus, 2·5 mm. diametro, pubescens, bilabiatim quadrifidus, dentibus tubum vix aequantibus. *Corolla* omnino glabra, vix 1 cm. longa ; vexillum obovatum, emarginatum ; alae oblongae, carinae leviter adhaerentes ; carina obtusa, alis longior, vexillum paulo superans. *Ovarium* sessile, 4-ovulatum, parce pubescens ; stylus superne glaber. *Legumina* plano-compressa, puberula nisi suturis pilosis, 1·2–2·0 cm. longa, 3·5 mm. lata, 2–4 articulata, sutura superiore fere recta, inferiore crenata, articulis subquadratis.

Indo-China. Cambodja : Angkor, *Godefroy ;* Tonkin, *Balansa*, 1252 ; Siam : Chiengmai, in mixed jungle on Doi Sootep, about 300 m., *Kerr*, 715.

544. **Derris Yappii**, *Craib* [Leguminosae-Dalbergieae] ; affinis *D. Korthalsianae*, Bl., sed foliolis trijugis cum impari haud approximato, et racemis foliis multo brevioribus differt.

Ramuli glabri, 5–7 mm. diametro, lenticellis valde prominentibus, cortice pallide cinereo, innovationibus parce hirsutis. *Folia* omnino glabra, 18–29 cm. longa, petiolo ad 5 cm. longo, rachi supra canaliculato ; stipulae deciduae, lineari-lanceolatae, 3 mm. longae. *Foliola* trijuga, ovata, ovato-lanceolata vel obovato-lanceolata, acuminata vel caudato-acuminata, apice obtusa vix mucronata, basi rotundata, chartacea, lateralia 7·5–10·5 cm. longa, 4–4·5 cm. lata, terminalia plerumque lateralibus distincte majora, usque ad 15·5 cm. longa et 7 cm. lata, nervis lateralibus 7–10-jugis cum nervulis supra vix subtus valde prominentibus ; petioluli circiter 5 mm. longi, glabri ; stipellae deciduae, filiformes, 3 mm. longae. *Racemi* compositi, conferti, ex axillis veteribus, foliis multo breviores, rachi rufo-hirsuto demum glabrescente ; pedicelli graciles, circiter 3 mm. longi, rufo-puberuli, apice bracteolis deciduis ornati. *Calyx* fere truncatus, rufo-puberulus, demum glabrescens, 2·5 mm. longus et fere 3 mm. diametro. *Corolla* calyce multo longior ; vexillum amplum, orbiculatum, emarginatum, 9 mm. longum, glabrum ; alae oblique oblongae, appendiculatae, carinae leviter adhaerentes, 8 mm. longae, glabrae ; carina obtusa, appendiculata, 7 mm. longa, extra apicem versus pubescens. *Stamina* medio monadelpha ; antherae uniformes. *Ovarium* sessile, circiter 5 mm. longum, pubescens, 4-ovulatum. *Stylus* parce pilosus, stigmate parvo terminali. *Fructus* ignotus.

Malay Peninsula. Kwala Arang, *Yapp*, 203.

545. **Sonerila Kerrii**, *Craib et Stapf* [Melastomaceae-Sonerileae]; affinis *S. Griffithii*, C. B. Clarke, sed foliis rosulatis, chartaceis, floribus multo majoribus differt.

Herba perennis, 4·7 cm. alta, cauli plus minusve hypogaeo perbrevi setulis brevibus vestito e rhizomate simplice vel parce-ramoso cylindrico vel irregularito tumido-incrassato orto; rhizoma 2–4 mm. diametro, usque ad 3·5 cm. longum. *Folia* subaequalia, petiolo 3–5 mm. longo, elliptico-lanceolata vel ovato-rotundata, apice obtusa vel rotundata, margine obscure serrato, usque ad 3 cm. longa, 2 cm. lata, basi subcuneata vel paulo rotundata, chartacea, supra viridia et setulis brevibus crassiusculis vestita, subtus purpurascentia et laxius quam supra vestita, nervis lateralibus utrinque 5–6 inferioribus 2–3 approximatis. *Cymae* plerumque 6-florae, longe pedunculatae, pedunculo pilis glandulosis parce ornato 2–6 cm. longo. *Alabastra* acutissima. *Calyx* anguste tubuloso-campanulatus, 8 mm. longus et fere 2 mm. diametro, parce glanduloso-pilosus, dentibus 3 brevibus late triangularibus. *Petala* 3, elliptico-oblonga, mucronata, 1 cm. longa, 4 mm. lata, glabra nisi subtus medio parce glanduloso-pilosa. *Stamina* 3; filamenta antheris aequalia, 8·5 mm. longa, circiter 1·5 mm. supra basin antherarum obtusam inserta, basi dilatata, glabra; antherae attenuatae, arcuatae. *Ovarium* 4 mm. altum, 1½ mm. diametro, apice ad 1 mm. excavatum, margine subintegro. *Stylus* glaber, 1·3 cm. longus.

Indo-China. Siam: Chiengmai, in open jungle on Doi Sootep 1350–1500 m., *Kerr*, 705.

546. **Vernonia Curtisii**, *Craib et Hutchinson* [Compositae-Vernonieae]; affinis *V. Gardneri*, Thw., sed caulibus, bracteis exterioribus, achaenis glabris et capitulis minoribus differt.

Herba 30–90 cm. alta (*fide Curtis*). *Caulis* teres, paulo sulcatus, glaber, superne ramosus. *Folia* alterna, elliptico-lanceolata, apice acuta, basi in petiolum brevissimum attenuata, 6–12·5 cm. longa, 1·5–4 cm. lata, serrata vel vix laciniato-serrata, membranacea, supra parce setulosa, subtus glabra, nervis lateralibus 7–12-jugis utrinque, subtus magis, prominulis. *Capitula* axillaria, solitaria, longe pedunculata, circiter 1 cm. diametro. *Involucri* bracteae multi-seriatae, oblongo-lanceolatae, usque ad 8 mm. longae, apice longe subulatae, herbaceo-appendiculatae, glabrae. *Receptaculum* subplanum, nudum. *Corolla* alba et caerulea (*fide Curtis*), glabra, 8 mm. longa, lobis linearibus circiter 2 mm. longis. *Antherae* fere 3 mm. longae, apice triangulares, subacutae. *Styli* rami 2 mm. longi, fere glabri. *Achaenia* valde 10-costata, 2·5 mm. longa, glabra. *Pappi* setae rigidae, usque ad 6 mm. longae, barbulatae.

Malay Peninsula. Kedah Province, on Langkawi Island, *Curtis*, 2127, 3690.

547. **Millottia depauperata**, *Stapf* [Compositae-Gnaphalinae]; a caeteris speciebus huius generis involucri phyllis tantum 4–5 latiusculis obtusis apiculatis et achenii rostro longo compresso ad angulos papilloso-pubescente distincta.

Annua; specimen unicum visum 6 cm. altum, a basi ramosum. *Folia* plus minusve congesta, linearia, acuta, basin versus attenata, ad 3 cm. longa, 1 mm. lata, juniora plus minusve lanata, deinde glabrata. *Capitula* solitaria, pedunculo primo superne lanato ad 3 cm.

longo suffulta, ad 6 mm. longa, ad 5 mm. diametro, turbinata. *Involucri* phylla 4–5, oblonga, obtusissima, minute tenuiterque mucronulata, ad 1·6 mm. lata, latissime scariosa, in vitta viridi media primo parce lanata. *Flores* 12–20, omnes hermaphroditi, receptaculo epaleaceo plano inserti, centrales steriles ut videtur. *Corolla* anguste tubulosa, superne subcampanulato-ampliata, aurea, 2 mm. longa, 4–5-dentata. *Antherae* lobi basi tenuissime lanato-caudati. *Stigmata* apiculata, infra apiculum circumcirca papillosa. *Achenium* (sub anthesi) lineare, 1 mm. longum, papillosum, in rostrum compressum latiusculum aequilongum ad angulos dense papilloso-ciliatum productum.

Collected by *J. Fraser* at Galafoot, Galashiels, Scotland, as a casual, and no doubt accidentally introduced from Australia.

548. **Gomphostemma intermedium**, *Craib* [Labiatae-Prasieae]; affinis *G. oblongo*, Wall., et *G. lucido*, Wall., a priore calycis dentibus multo brevioribus, a secunda foliis supra pilis stellatis obsitis differt.

Frutex erectus, ad 2 m. altus (*fide Kerr*); rami scabri, subtetragoni, circiter 5 mm. diametro. *Folia* elliptico-lanceolata vel oblongo-lanceolata, 10–22 cm. longa, 3·5–6·5 cm. lata, apice acuta, basi attenuata vel subrotundata, supra pilis stellatis obsita, scabridula, subtus hirsuta, nervis lateralibus circiter 6-jugis cum nervulis supra impressis subtus prominentibus, margine subintegro repando-denticulato vel rarius subcrenulato, chartacea, petiolata, petiolo 5–12 mm. longo. *Verticillastri* densi, multiflori, floribus singulis breviter pedicellatis, bracteis lanceolatis calyce multo minoribus. *Calyx* tubuloso-campanulatus, dense tomentosus, tubo circiter 10 mm. longo 2 mm. diametro, dentibus triangularibus acutis circiter 2·5 mm. longis. *Corolla* alba (*fide Kerr*), apice antice incurva, extus (lobo labii antici medio excepto) pubescens, 6 cm. longa, parte tubi cylindrica 3 cm. longa, intus glabra. *Stamina* 1·5 cm., postica 1 cm. longa; filamenta compressa, 1 mm. lata, antica parcissime pilosa, marginibus papillosis. *Ovarium* dense hirsutum. *Stylus* pilis divergentibus apicem versus ornatus, 4·5 cm. longus. *Fructus* ignotus.

Indo-China. Siam: Chiengmai, in evergreen jungle on Doi Sootep, about 730 m., *Kerr*, 733.

549. **Phyllanthodendron roseum**, *Craib et Hutchinson* [Euphorbiaceae-Phyllantheae]; a *P. mirabili*, Hemsl., foliis oblanceolatis, floribus longe pedicellatis, calyce glabro, et ovario piloso distinctum.

Frutex 3·5 m. altus (*fide Kerr*). *Ramuli* teretes, puberuli, cortice brunneo. *Folia* alterna, brevissime petiolata, oblanceolata, apice acuminata, mucronata, basi attenuata, 8–16 cm. longa, 2–5 cm. lata, subcoriacea, glabra, margine integro, nervis lateralibus 10–12-jugis utrinque, subtus magis, prominulis; stipulae ovato-lanceolatae, acutissimae, circiter 4 mm. longae, basi in appendicem bilobatam productae. *Flores* axillares, fasciculati. ♂ *Pedicelli* usque ad 1 cm. longi, gracillimi, glabri. *Calycis* segmenta 5, subaequalia, lanceolata, longe acute acuminata, 3 mm. longa, 1·5 mm. lata, 1-nervia, membranacea, glabra. *Disci* glandulae liberae, petaloideae, lineares, planae, apice truncatae vel rotundatae, 1·5 mm. longae, 0·25 mm. latae, glabrae. *Stamina* 3; filamenta in columnam 0·5 mm longam connata; antherae liberae, 0·75 mm.

longae, connectivo in appendicem lineari-subulatam 1 mm. longam glabram producto. ♀ *Pedicelli* gracillimi, usque ad 4 cm. longi. *Calycis* segmenta 6, quam mascula paulo longioria. *Disci* glandulae maris. *Ovarium* 3-loculare, late ovoideum, albo-pilosum; styli bilobati, 0·5 mm. longi, glabri, lobis obtusis glabris. *Capsula* subglobosa, rosea (*fide Kerr*), 1·5 cm. diametro, tenuiter puberula, distincte reticulata, exocarpio membranaceo, endocarpio corneo 0·5 mm. lato; semina 7–8 mm. longa, 3–3·5 mm. lata.

Indo-China. Siam: Chiengmai, in evergreen jungle by a stream on Doi Sootep, about 730 m., *Kerr*, 697.

550. Urceocharis edentata, *C. H. Wright* [Amaryllidaceae-Amarylleae]; ab *U. Clibrani*, Mast., corona inter filamenta inappendiculata differt.

Bulbus tunicis brunneis membranaceis vestitus; collum breve, 1·3 cm diametro. *Folium* solitare, elliptico-oblongum, breviter acuminatum, basi cuneatum angulis exterioribus rotundatis, glaberrimum; costa supra canaliculata, subtus lata prominensque. *Scapus* terminalis, 20 cm. altus, 5 mm. diametro, dilute viridis, circa 4-florus; bracteae brunneae, 2·5 cm. longae, 5 mm. latae, scariosae; pedicelli 1·5 cm. longi. *Perianthium* album, prope apicem extus cremeum; tubus cylindricus, 2 cm. longus, 2 mm. diametro; limbus late campanulatus, 4·5 cm. diametro; lobi elliptici, acuti, 4 cm. longi, 1·5 cm. lati. *Stamina* exserta; filamenta basi dilatata connataque. *Ovarium* 8 mm. longum, trilobum; ovula pauca.

Peru. *Forget.*

This has been described from a plant which flowered with Messrs. Sander & Sons in July last and is probably a natural hybrid. The only other recorded hybrid between *Urceolina* and *Eucharis* is *Urceocharis Clibrani*, Mast. in Gard. Chron. 1892, xii. p. 214, fig. 36.

V.—MISCELLANEOUS NOTES.

Visitors during 1909.—3,360,221 visitors to the Royal Botanic Gardens have been recorded during the year 1909. These figures shew an increase of 397,507 over those for the year 1907, which up to the present were the largest numbers on record. During the last ten years (1899–1908), 17,861,093 persons have visited the gardens, giving an average of 1,786,109. The total number of visitors on Sundays during 1909 was 1,384,369, and on week-days 1,975,852. Sunday visitors have increased by 62,985; in this connection it is of interest to notice that until the year 1907 visitors to the gardens on Sundays had only on three occasions exceeded 700,000. The number of visitors on week-days shews an increase of 281,639 over the previously recorded maximum in 1907.

The greatest attendance on any one day was 103,895 on Whit Monday, May 31st. The smallest number on any one day was 191, on November 29th. The largest and smallest Sunday attendances were 71,584 and 492 respectively, and in the former figures a slight increase has occurred.

The detailed monthly returns are given below :—

January	46,561
February	72,898
March	57,020
April	379,372
May	545,984
June	329,335
July	348,820
August	1,016,114
September	314,462
October	139,009
November	67,046
December	43,600
	3,360,221

Additions to Gardens, 1909.—Additions to the collections of plants cultivated at Kew have been made during the year by exchanges with other gardens, private as well as public, and by purchase from nurserymen and others. Contributions of plants and seeds have been received from the following botanic gardens :—

Adelaide. 286 packets of Australian seeds.

Arnold Arboretum. Many packets of seeds and plants collected in China by Mr. E. H. Wilson.

Calcutta. Collection of seeds from the Himalaya ; tubers of *Amorphophallus campanulatus.*

Ceylon. Wardian case of orchids, including *Dendrobium MacCarthiae.*

Demerara. Wardian case of plants, including *Sapium Jenmani ;* various palm seeds.

Gold Coast. Orchids and seeds of varieties of *Elaeis guineensis.*

Mauritius. Palm seeds.

Kumaon (Government Gardens). *Lilium polyphyllum* and *L. Wallichianum.*

Montserrat. Seeds of *Pilocarpus racemosus* for distribution.

S. Nigeria. African orchids, tubers and seeds.

Penang. Wardian case of plants ; seeds.

Singapore. Wardian cases of orchids, and other plants, many new to cultivation ; seeds of *Raphia Hookeri, R. Ruffia, Psychotria fulva.*

Sierra Leone. *Acidanthera aequinoctialis ;* various orchids.

Nyasaland. Seeds of *Securidaca longipedunculata.*

Sydney. Plants of *Dendrobium falconirostre ;* seeds of Australian plants.

Exchanges were made with the Botanic Gardens of Edinburgh, Glasnevin, Cambridge and Oxford, and with most of the European gardens upon whom Kew is largely dependent for seeds of those annual herbaceous plants which fail to produce seeds at Kew.

Professor Pearson, of Cape Town, sent a collection of seeds obtained by him in German West Africa and Angola. Captain Heneage, H.M.S. Hyacinth, obtained for Kew seeds of *Phoenix*

andamanensis from the Andaman Islands. Mr. J. T. Norman, City Central Laboratory, Leadenhall Street, presented tubers of *Raphionacme utilis*. Professor W. Saunders, Ottawa, sent seeds of Canadian rice-grass (*Zizania aquatica*) for distribution. Mr. R. Tower, H.M. Minister, Mexico, presented a collection of Mexican cacti. Mrs. Epps, Upper Norwood. presented orchids and a large plant of *Theobroma Cacao*. Mr. C. F. Monro, Rhodesia, presented a collection of seeds obtained by him in that country. Mr. E. Ashworth, Wilmslow, gave a plant of *Trevoria chloris*. Dr. Perez, Puerto Orotava, Teneriffe, presented seeds of *Pinus canariensis*, *Convolvulus floridus* and other plants of the Canaries. Miss Mangles, Littleworth Cross, presented a number of large rhododendrons. From Messrs. J. Veitch & Sons, a collection of Chinese plants, named and unnamed, has been received. Messrs. F. Sander & Sons have sent a selection of plants and seeds from a collection made by them in Peru. Messrs. Bees, Ltd., Neston, sent various new Chinese primulas and other plants.

Among the plants of interest distributed from Kew during the year were the following :—

Zizania aquatica (seeds), *Pouteria suavis* (seeds and plants). *Pilocarpus racemosus* (seeds), *Securidaca longipedunculata* (seeds), *Raphionacme utilis* (seeds), *Pinus canariensis* (seeds), *Androstachys Johnsonii* (seeds), *Salix alba coerulea* (plants). Fifteen Wardian cases of economic plants were despatched to the Colonies and India. A large number of plants were distributed among botanical and educational establishments. There was an unusually large demand for seeds ripened at Kew and offered for distribution in *Bulletin*, *Appendix* I., 1909.

Of hardy trees and shrubs the most important contributions have been made by Professor Sargent of the Arnold Aboretum. In continuation of the consignments of Chinese seeds collected by Mr. Wilson, so liberally sent in 1908, some 400 further packets were received in 1909, most of them unnamed and under number only. Amongst them were 60 packets of Rhododendron seeds, all of which, with the exception of four or five packets, have germinated well. We have also to thank Professor Sargent for numerous living plants, especially for 25 lots of new Chinese Oaks. Among other things of more than usual interest are *Pterocarya Rehderi* (a new hybrid), *Betula Kenaica*, *Æsculus Bushii* and *Æ. chinensis*. This is perhaps the first introduction to Great Britain of this fine Chinese Horse Chestnut, for although many plants under the name have been grown in Europe during the last 30 years, none has been true.

Messrs. J. Veitch & Sons have sent a very fine collection of Chinese trees and shrubs, including the following rare and interesting species :—*Acer griseum* and *A. tetramerum*, *Berberis Gagnepainii* and *B. verruculosa*, *Dipelta ventricosa*, *Deutzia mollis*, *Camellia cuspidata*, *Dipteronia sinensis*, *Kolkwitzia amabilis*, *Larix Potaninii*, *Meliosma Veitchiorum*, *Neillia szechuanica*, *Syringa pinnata* and *Tilia Oliverii*. All these belong to the first batch of their

respective kinds ever raised or seen in this country, and they were supplemented by about 40 different lots of unnamed trees and shrubs, most, if not all, new to cultivation.

In exchange for other shrubs, about a score new Chinese species were obtained from the Hon. Vicary Gibbs, of Aldenham. They represented species of Wilson's collecting in China, which had either failed at Kew or of which seeds had not been received.

From Mr. A. Henry, Reader in Forestry at Cambridge, a quantity of seed of the Western Larch (*Larix occidentalis*) was received in February. These germinated in great numbers, and will enable this beautiful and interesting larch to be well represented at Kew in future years.

A large number of Himalayan seeds were received from the Calcutta Botanic Garden, and valuable contributions from M. Maurice de Vilmorin, and from the Royal Botanic Gardens of Berlin and Edinburgh have also to be acknowledged.

Waterfowl.—During the past year some interesting additions by presentation and exchange have been made to the collection of waterfowl and other birds in the Royal Botanic Gardens. They include—

A Mandarin Drake and a pair of Shoveller Ducks received in exchange through Col. C. G. Tottenham, Ballycurry, Ashford, Co. Wicklow, Ireland.

A pair of Pochards received in exchange through the Ven. Archdeacon Bevan, the Rectory, Chelsea.

A pair of Widgeon from the Zoological Society of London.

A pair of black Teal from Col. A. E. Balfour, Kneller Hall, Hounslow.

A pair of lavender-coloured Guinea fowl presented by Mrs. Orde, Nunnykirk, Morpeth.

A pair of Gadwall have also been added to the collection of British Duck on the lake.

An occurrence of interest in the spring was the hatching of a black-necked cygnet. Two eggs were laid, only one of which proved to be fertile. The young bird lived for about a fortnight, but was unable, apparently, to withstand the inclement weather about that time. A pair of storks have been reared as usual, and several Carolinas and other duck. The Tufted duck has quite established itself at Kew and breeds freely in the Gardens.

Dracontium gigas.—A fine example of this remarkable aroid may now be seen in flower in the T Range at Kew. It resembles *Amorphophallus* in having a large fleshy tuber and a single annual leaf of large dimensions, the petiole beautifully mottled and supporting a large spreading decompound leaf-blade. The inflorescence, which is developed after the leaf has withered, is a fleshy, funnel-shaped dark purple spathe, 2 feet 3 inches long, supported on a mottled peduncle, 18 inches long, and the short, thick spadix is entirely hidden by the folding of the lower part of the

spathe. The odour of the flowers is not agreeable. The plant was discovered in Nicaragua by Dr. Seemann in 1868, who sent tubers of it to Mr. W. Bull, of Chelsea, where it flowered in December, 1872, and a figure of it, under the name of *Godwinia gigas*, was published in the *Botanical Magazine*, t. 6048, where the following particulars are given :—

"In its native state the tuberous root of *Godwinia* attains a circumference of 2 feet 2 inches, and a weight of 90–92 ozs. The petiole reaches 10 feet in height, and has a metallic lustre and mottled surface resembling a snake standing erect, and bears a blade, 3 feet 8 inches long. The peduncle is shorter than the petiole, about 5 feet and a half, and the spathe alone is 2 feet long. The plant grows with great rapidity, and emits a peculiar odour. Dr. Seemann named this prodigy after Mr. George Godwin, F.R.S., the eminent architect, a gentleman of varied attainments, in especial recognition of his philanthropic efforts to spread a love of window-gardening and other pursuits amongst the humbler classes of London." The Kew plant was obtained from Mr. Bull. It flowered at Kew in 1889 and again several times since. There is a good figure of this plant in the *Gardeners' Chronicle* for Jan. 18, 1873.

W. W.

Museums.—During the year 1909 much time has necessarily been devoted to dealing with the large number of products obtained from the recent exhibitions held in London. This work is now completed, and much of the duplicate material has been distributed to other institutions. In addition, a good deal of work has been done, as in previous years, in generally improving and re-labelling permanent collections. It was found necessary to close Museum No. I. for a few weeks during the progress of painting and other repairs.

An exhibit similar to that forwarded to the Forestry section of the Bath and West and Southern Counties Show, held the previous year at Dorchester, was prepared for the annual show at Exeter in 1909, and a series of specimens was also forwarded to the Board of Agriculture and Fisheries for their exhibit at the "Imperial International Exhibition," held at Shepherds Bush.

During the year under review 145 contributors have presented a large number of miscellaneous products to the Museum, the bulk of which have already been dealt with. Of these donations special mention must be made of the bust in bronze of Charles Darwin, presented by the Bentham Trustees (*K.B.* 1909, p. 315), and a fine series of Javanese photographs presented by the Director, Department of Agriculture, Buitenzorg.

In connection with the Forestry section of the Museum, for which material is being gradually collected, many specimens have been received, consisting for the most part of unseasoned timber, which will not be available for exhibition for some time.

Fully labelled duplicates, to the number of 1,731, have been distributed during the year to 85 recipients, including the Royal Naval College, Osborne; Botany School, Cambridge; Museum

and Art Gallery, Sunderland; Municipal Museum, Stockport; Tottenham Museum; Avondale Forestry Station, Rathdrum, Co. Wicklow; &c.

From nearly 350 commercial firms, chiefly in London and Liverpool, from Colonial correspondents and scientific institutions, specimens of various products have been received for determination, and in the majority of enquiries the fullest available information has been communicated, in addition to the scientific name of the product.

The re-arrangement of a section of the Timber Museum has delayed the preparation of a new edition of the Guide. The first instalment of "The Useful Plants of Nigeria," published as *Kew Bulletin; Additional Series IX., Part I.*, by an officer of the department, has been issued. The permanent staff of the Museum has been increased by the appointment of an additional Assistant.

Presentations to Museums.—The following miscellaneous specimens have recently been received:—

His Grace the Duke of Wellington, Stratfieldsaye, Mortimer, Bucks. Examples of home-grown creosoted timber, together with specimens of ash affected with ash canker.

Right Honourable the Earl of Ducie, Tortworth Court, Gloucester. Section of wood of *Castanopsis chrysophylla*.

Sir C. T. Dyke Acland, Bart., Killerton Park, Exeter. Seven planks and five transverse sections of home-grown timber.

Miss Talbot, Margam Park, Port Talbot. Specimens of home-grown creosoted timber, together with particulars of experiments with creosote carried out on the estate.

Mr. C. Carus-Wilson, Strawberry Hill. Specimens of oak roots encircling flint stones.

Messrs. Joseph Gardner & Sons, Liverpool. Samples of wood of membrilla, white mangrove, and tulip tree.

Mr. Moss, Forest Gate. Twenty cases of mounted specimens of woods employed in the walking-stick industry.

Mr. D. Hill, Watford. Specimens of oak and beech obtained in excavating for the foundations for additions to the Watford gas works. These specimens were accompanied by a plan giving minute details as to the position in which the woods were found.

Dr. Perez, Puerto Orotava, Teneriffe. Wood specimens of *Juniperus Cedrus*, *Convolvulus floridus* and *Convolvulus scoparius*.

The President, Imperial Forest Research Institute, Dehra Dun, India. Series of photographs of forest trees, &c.

Mr. A. E. Evans, Aburi, Gold Coast. Specimens to illustrate diseases of *Hevea brasiliensis*, *Castilloa elastica*, and *Theobroma Cacao*.

Director of Agriculture, Gold Coast. Leaves, flowers and fruits of the oil palm (*Elaeis guineensis*).

Messrs. Bibby & Sons, Liverpool. "Shea-butter" seeds (*Butyrospermum Parkii*) and a sample of "Djave nuts" (*Mimusops Djave*) from West Tropical Africa.

Director, Department of Agriculture, Buitenzorg, Java. Photographs of the Botanic Garden at Buitenzorg and of scenery in Java.

Mr. T. W. Kirk, Department of Agriculture, Wellington, New Zealand. Series of samples of New Zealand hemp (*Phormium tenax*) and illustrations of the industry.

J. M. H.

Research in Jodrell Laboratory in 1909 :—

Boodle, L. A., and Hiley, W. E.—On the Vascular Structure of some Species of *Gleichenia*. (Ann. Bot., Vol. XXIII., pp. 419–432, t. 29, with three figs. in text.)

[Boodle, L. A.]—Padi. (Kew Bull., 1909, pp. 277–279.)

Greshoff, M. (the late).—Phytochemical Investigations at Kew. (Kew Bull., 1909, pp. 397–418.)

Lawson, A. A.—The Gametophytes and Embryo of *Pseudotsuga Douglasii*. (Ann. Bot., Vol. XXIII., pp. 163–180, tt, 12–14.)

Massee, G.—"Briar Scab." (The Rose Annual, 1909, p. 64.)

Massee, G.—Plant Diseases.—IX. Dry Scab of Potatoes (*Spondylocladium atrovirens*, Harz.). (Kew Bull., 1909, pp. 16–18, with figs. in text.)

[Massee, G.]—Dry Scab of Potatoes. (Journ. Board Agric., Vol. XVI., pp. 31–32.)

[Massee, G.]—Varieties of Scab in Potatoes. (Journ. Board Agric., Vol. XV., pp. 749–751, with two plates.)

Massee, G.—Injuries to Plants due to Hail and Frost. (Kew Bull., 1909, pp. 53–55, with one plate.)

Massee, G.—A *Funtumia* Disease (*Nectria funtumiae*, Massee). (Kew Bull., 1909, pp. 147–148.)

Massee, G.—Cucumber and Tomato Canker (*Mycosphaerella citrullina*, Grossenb.). (Kew Bull., 1909, pp. 292–293, with one plate.)

Massee, G.—Coffee Diseases of the New World. (Kew Bull., 1909, pp. 337–341, with figs. in text.)

Massee, G.—The Structure and Affinities of British Tuberaceae. (Ann. Bot., Vol. XXIII, pp. 243–263, t. 17.)

Massee, G.—Edible Fungi. II. The Parasol Mushroom (*Lepiota procera*). (Journ. Board Agric., Vol. XV., p. 839, with one plate.)

Massee, G.—The Greening of Potatoes. (Journ. Board Agric., Vol. XVI., pp. 177–180, with one plate.)

[Massee, G.]—Report on "Sprain" in Potato Tubers. (Journ. Board Agric., Vol. XVI., pp. 647–648.)

Sprague, T. A., and Boodle, L. A.—Kokoti (*Anopyxis ealaensis*, Sprague). (Kew Bull., 1909, pp. 309–312.)

Stapf, O., and Boodle, L. A.—*Pedera* and *Nectaropetalum*. (Kew Bull., 1909, pp. 188–191.)

Mr. C. K. Bancroft made a study of the life-history of *Cladosporium herbarum*, and investigated the brown spot disease of tomato and a disease of cacao caused by *Colletotrichum Cradwickii*.

Prof. F. de las Barras made some cultural experiments on the germination of Fern-spores.

Mr. L. A. Boodle studied the anatomy of some species of *Nectaropetalum* and other Dicotyledonous genera in relation to their affinities, and investigated a case of canker-like growths on the stem of a species of *Ribes*, and also continued some experiments with Cruciferous seedlings: see above.

Mr. J. Fraser, on behalf of Lord Avebury, was engaged in an extended study of the pollen of various plants.

Dr. P. Georgevitch finished a research on the conditions of growth of a species of *Bacterium* from a thermal spring, and began a study of certain cases of apospory and apogamy.

Dr. M. Greshoff (the late) carried out a chemical examination of a large number of plants: see above.

Prof. P. Groom made experiments relating to the transpiration and the rate of ascent of water in trees.

Dr. G. van Iterson (Junr.) began a research on laticiferous tissue and on the formation of resin and gum in plants.

Mr. A. J. Maslen continued his work on the anatomy of *Mesoxylon* (*Poroxylon*) *Sutcliffii*, a fossil plant from the Coal-Measures.

Mr. T. G. B. Osborn studied the root-tubercles of *Podocarpus* and *Dacrydium*, and the mycorrhiza contained in them.

Dr. D. H. Scott studied some fossil plants of Devonian age.

Miss E. L. Stephens made some observations on an apogamous species of *Pteris*.

L. A. B.

Pathology.—The number of reports issued during 1909 exceeded in number those issued during any previous year. Amongst diseases of potatoes a noticeable feature was the great extension of "Corky Scab," caused by *Spongospora solani*. On the other hand, "Dry Scab" due to *Spondylocladium atrovirens*, which was recorded during 1908, was not received at Kew during the past season. A series of experiments on the "greening" of potatoes were conducted, and the results published in the Journal of the Board of Agriculture, vol. xvi., p. 177, with plate. A considerable amount of time has been devoted to investigating the algae and fungi occurring in sewage and contaminated river-water, on behalf of the Royal Commission on sewage disposal. An investigation of the fungi causing discoloured spots on chilled beef from Argentina, has also been in hand during the past year.

A considerable amount of diseased material from the colonies and outside sources has been submitted to Kew during the past year, including *Diplodia cacaoicola*, Henn., the cause of a disease which is a source of serious damage to Cacao in the West Indies. This disease is also prevalent in the Island of St. Thomé, whence material has been submitted to Kew for examination by the representative of the Portuguese Government.

G. M.

Additions to the Herbarium during 1909.—During the year nearly 14,000 specimens were received as donations or exchanges, while just over 8,000 were purchased. The principal collections are enumerated below.

Europe. *Presented:* Hungarian plants, by Dr. A. de Degen; South France and the Pyrenees, by Mr. C. E. Salmon; "Kryptogamae Exsiccatae," Cent. xvii., by the Imperial Natural History Museum, Vienna; Crete, by Mr. A. Trevor-Battye; British Marine Algae, by Mr. A. D. Cotton.

Purchased: Fiori, Béguinot and Pampanini, "Flora Italica Exsiccata," Cent. viii.–x.; H. Sydow, "Mycotheca Germanica," Fasc. xvi.–xvii.

China and Japan. *Presented:* Japanese Algae collected by Prof. Yendo and Mr. H. G. Brand, through Mr. A. D. Cotton: Fokien, by Mr. S. T. Dunn; China, by Mgr H. Léveillé; photographs of Chinese plants in their natural habitats taken by Mr. G. Forrest, by the Royal Botanic Garden, Edinburgh.

Purchased: Madame L. Raoulx, Dr. Savatier's Japanese plants.

India and Malaya. *Presented:* India, by Mr. A. Meebold and Mr. W. G. Craib; Travancore, by Mr. T. F. Bourdillon; Ceylon Fungi, by Dr. F. von Höhnel; Burma, by Mr. J. H. Lace; Sikkim, by the Royal Botanic Garden, Sibpur; Malay Peninsula, by the Royal Botanic Garden, Sibpur, the Botanic Garden, Singapore, Prof. R. H. Yapp, Mr. D. T. Gwynne-Vaughan and Mr. F. R. Long; Siam, by Dr. A. F. G. Kerr; Philippine Islands, by Mr. Elmer D. Merrill; Indo-China, by the Paris Herbarium; Java (Plantæ Junghuhnianae), by the Leiden Herbarium, (Fungi), by Dr. F. von Höhnel; British New Guinea, by Mr. F. M. Bailey; Dutch New Guinea, by the Buitenzorg Botanic Garden.

Purchased: Elmer, Philippine Islands; Hubert Winkler, South East Borneo.

Australasia. *Presented:* Australian Algae and Fungi, by Mr. F. M. Bailey; New Zealand, by Miss L. S. Gibbs; plants used in the preparation of "Illustrations of the New Zealand Flora," by Mr. T. F. Cheeseman; Fiji, by Miss L. S. Gibbs; New Caledonia, by the Paris Herbarium.

Purchased: Max Koch, Western Australia; Savatier, Tahiti.

Tropical Africa. *Presented:* French Guinea, by Prof. H. Lecomte; Sierra Leone, by Messrs. A. H. Unwin and C. W. Smythe; Gold Coast, by Mr. J. Anderson; Lagos, by the Conservator of Forests; Northern Nigeria, by the Imperial Institute (Dr. J. M. Dalziel), Mr. B. E. B. Shaw; Southern Nigeria, by Mr. A. H. Unwin and Mr. J. L. Williams; South Abyssinia, by Dr. R. E. Drake-Brockman; British East Africa, by Mr. E. Battiscombe, Mr. W. Scoresby Routledge and Mr. M. S. Evans; Uganda, by Mr. R. Fyffe; Prof. H. H. W. Pearson, Angola, by the Sladen Trustees, Rev. F. A. Rogers; Rhodesia and Matabeleland, by Dr. S. Schönland and the Department of Agriculture, Rhodesia; Mozambique, by Mr. W. H. Johnson.

Purchased: R. Schlechter, West Africa; Kaessner, Central Africa.

Mascarene Islands. *Presented:* Madagascar, by Dr. J. Briquet and Prof. H. Jumelle; Seychelles, Aldabra and Astove, by Dr. J. Stanley Gardiner.

South Africa. *Presented*: Miss R. Leendertz, Transvaal, by the Transvaal Museum; Mr. J. Burtt Davy, Transvaal, by the Transvaal Department of Agriculture; Natal, by Mr. J. Medley Wood; Basutoland and Griqualand East, by the South African Museum; Cape Colony, by the Department of Agriculture, Cape Town, Dr. S. Schönland, Mr. E. E. Galpin and Dr. Hans Schinz; K. Keytel, Tristan da Cunha, by the South African Museum.

Purchased: Scheffler and Rudatis; Pegler, Transkei.

North America. *Presented:* United States, by Prof. C. S. Sargent and Mr. W. W. Eggleston; California, by Prof. W. A. Setchell.

Purchased: Bush, United States; Blumer, Arizona; Collins, Phycotheca Boreali-Americana, Fasc. i.–xxxii.; Macoun, Canadian mosses; Baker, "Economic Plants of the World."

Mexico. *Presented:* By the Smithsonian Institution.

West Indies. *Presented*: W. Harris, Jamaica, by the New York Botanical Gardens; Siphoneae from the Danish West Indies, by Dr. F. Börgesen; Tobago, by Mr. W. E. Broadway.

South America. *Presented*: Brazil, by Dr. A. Usteri; R. S. Williams, Bolivian mosses, by Sir Martin Conway; specimens of Malvastrum and Nototriche, Mr. A. W. Hill.

Purchased: Savatier Herbarium; Fiebrig, Paraguay.

The most important collection received during the year has been the Herbarium of the late Dr. P. A. L. Savatier, which was purchased from his daughter, Mme. L. Raoulx, and of which a detailed account was published in the *Kew Bulletin*, 1909, pp. 148–150. Another important donation is that from the Paris Herbarium, which contains over 1,100 named specimens from Indo-China and New Caledonia. Specimens of British New Guinea orchids, described by Mr. F. M. Bailey, have been received from him. Miss L. S. Gibbs has presented specimens in illustration of her paper, "A Contribution to the Montane Flora of Fiji," published in the Journal of the Linnean Society, Botany, vol. xxxix. pp. 130–212. Dr. G. B. P. Hochreutiner's new species of Madagascar plants have been received from Dr. J. Briquet. Dr. J. Stanley Gardiner has sent specimens collected on the various islands explored during the Sealark Expedition. The 32 fascicles of Collins' Phycotheca Boreali-Americana, which have been purchased, form the most important collection of North American Algae yet published. Prof. C. S. Sargent and Mr. W. W. Eggleston have presented many specimens of critical North American Crataegi.

C. H. W.

Presentations to the Library during 1908.—The names of the donors of books or pamphlets added to the library during 1908 are indicated in the supplement to the catalogue which appeared as Appendix II. of the *Kew Bulletin*, 1909, and certain of these, presented by the Bentham Trustees and Sir Frank Crisp, are

commented on at p. 133 of the *Bulletin* of the same year. Several other presentations made to the library in the course of 1908 have been selected for inclusion in the present note.

The Bentham Trustees have, in addition to other works, presented a well preserved copy of the French edition of Dodoens, *Cruydeboeck*, which was translated by Clusius and published at Antwerp in 1557, only three years after the date of the original Flemish edition, of which the library possesses a good copy. Like the original the translation is a small folio, containing numerous excellent woodcuts of plants. From the same source was received the *Canon Medicinae* of Husain Ibn 'Abd Allāh, who is perhaps better known under the name of Ibn Sīnā, or better still, under that of Avicenna. The edition presented was published at Venice in 1595, in two folio volumes, and is based on that version of Avicenna's writings which is attributed to Gerard of Cremona. The *Journal et flore des jardins*, edited by Boitard, Cels, and others, and continued as *Annales de flore et de pomone, ou journal des jardins*, in fourteen volumes, published in Paris between the years 1832 and 1845; the *Annales*, vols. i–xxxi., 1873–1906 and *Bulletin*, vols. i–xi., 1883–93, of the Société Botanique de Lyon; series 5 of Bourdier's *Icones mycologicae* and vol. iii. (2 copies) of Elwes and Henry, *Trees of Great Britain and Ireland*, are other important contributions to the library by the Bentham Trustees, who have also, as in former years, presented the issues for the year of about twenty periodical publications.

Sir J. D. Hooker has continued to present the publications of several societies or academies of which he is a member, and the library is indebted to him for eight volumes of manuscripts, chiefly by himself or by Sir W. J. Hooker. These include Sir Joseph's *Tour in the United States of America*, in 1877, Sir W. J. Hooker's *Journal of a Tour in Switzerland*, in 1814, and the diplomas granted to Sir W. J. Hooker, with correspondence relating to them.

The *Mitteilungen des Botanischen Museums der Universität Zürich* and other works prepared in the same establishment, which comprise dissertations by H. Aisslinger, F. Ebert, M. Jaeggli, G. Koestler, E. Kuhn, G. Nonweiler, K. Peters and A. Wolff, have been added to the library through the kindness of Dr. Hans Schinz; and the publications of the Department of Agriculture in the Dutch East Indies have been received from the Director. Amongst these is a set, complete except for the first part which Dr. Koorders presented himself, of the *Bijdrage tot de Kennis der Boomsoorten van Java*, by Dr. S. H. Koorders and Dr. Th. Valeton.

The Royal University of Upsala contributed a collection of about 120 pamphlets, chiefly dissertations, 56 of which are the original issues of those which were submitted by pupils of Linnaeus, and which were subsequently published in the *Amoenitates Academicae*.

To the Secretary of State for India the establishment is indebted for a complete set of the new edition in 26 volumes of *The Imperial Gazetteer of India*, *The English Factories in India*, 1622–1623, by W. Foster, the second edition of Schlich's *Manual of Forestry*, vol. v., and three copies of *The Commercial Products of India*, by Sir George Watt; to the Director of Military Operations, War

Office, for a set of the *Geographical Indices* compiled by Alexander Knox ; and to the Trustees of the British Museum for the second edition of the *Guide to Sowerby's Models of British Fungi*, by W. G. Smith, and the *Synopsis of the British Basidiomycetes*, by the same writer.

A copy of the second volume of the remarkably fine series of illustrations issued under the title of *Iconographie des essences forestières du Japon*, by H. Shirasawa, has been presented by the author, from whom the first volume, dated 1900, with a thin octavo volume of text, was received in 1902. No text accompanies the second volume.

The interesting collection of the botanical manuscripts of the late Richard Spruce, and letters addressed to him by Sir W. J. Hooker, G. Bentham and others, which were received at Kew through the kind offices of Dr. A. R. Wallace, are referred to in detail in the *Kew Bulletin*, 1908, p. 464.

There are many contributions to the library received through the kindness and liberality of their authors which prove indispensable for the efficient working of the establishment, and which, did space permit, should obtain more than the notice accorded to them by a mere catalogue entry ; but the value of the assistance afforded to Kew by these contributors and by the chiefs of the various kindred institutions in India, in our colonies, in America and other parts of the world, whose publications are regularly received, is best estimated by the excellent use made of the literature entrusted to its keeping and thereby rendered freely accessible to its large staff and its numerous visitors.

Botanical Magazine for January.—The plants figured are *Syringa Bretschneideri*, Lemoine, *Iris minuta*, Franch. et Sav., *Dipelta ventricosa*, Hemsl., *Ourisia macrophylla*, Hook., and *Eria rhodoptera*, Reichb. f.

The Syringa was introduced into Europe from Northern China between 1879 and 1883 ; it is most nearly allied to *S. Josikaea*, Jacq. The panicles of flowers—18 in. high and 12 in. across—are at their best in early June, when those of the common Lilac have faded. The plant is therefore a valuable garden shrub. *Iris minuta* is a beautiful little species from Japan with yellow flowers flecked with purple. This species is of interest owing to the formation of small tubers on the roots. *Dipelta ventricosa*, a native of Western China, owes its introduction to cultivation to the enterprise of Messrs. J. Veitch & Sons, and like *D. yunnanensis* was found by Mr. E. H. Wilson at an altitude of 8,500 ft. The flowers are red outside and whitish orange within. *Ourisia macrophylla* is a remarkably pretty plant from New Zealand, nearly allied to *O. macrocarpa*, Hook. f., and *O. robusta*, Col. The plant here figured was obtained from Messrs. Bees, Ltd., in 1907, and was kept under glass through the winter ; it flowered in a cold frame in April. This species is readily propagated by means of seed. *Eria rhodoptera* was first described by Reichenbach in 1882. The subject of the plate, which is a native of the Philippines, was received in 1904 from the Botanical Garden at Heidelberg.

It is most nearly related to *E. Dillwynii*, Hook., of the section *Hymeneria*, but is one of the most distinct of this section on account of its crimson petals and lip.

New Zealand Forest.—There is no vegetation on the globe which, whilst existing under climatic conditions not very dissimilar to those of Great Britain, yet presents so marked a contrast to its flora as that of New Zealand. This aspect has been vividly brought before us by the well-illustrated report* on the Vegetation of the Higher Waimarino District of New Zealand, recently issued by the Government. Waimarino is an elevated district some 1,100 sq. miles in extent, situated about the middle of North Island on the western side. It varies from 25 to 45 miles in diameter and is intersected by the main trunk railway. Its altitudes vary from a few hundred to over 4,000 feet above sea-level, and it appears to comprise within its limits most of the plants belonging to the central botanical province of New Zealand. This interesting report deals with the vegetation at elevations of 1,000 feet and over. At, and immediately above that level, the ground is covered with high forest largely composed of taxads, or allies of our common yew, amongst which *Podocarpus Totara*, *P. dacrydioides*, *P. spicatus* and *Dacrydium cupressinum* are the most conspicuous elements. Of *P. dacrydioides* Mr. Turner found a specimen close upon 200 feet high. At higher levels, and approximating 3,000 feet, beeches begin to prevail, especially *Nothofagus cliffortioides*. The pure forest is intersected by tracts of boggy or dry ground covered with a low vegetation composed of such typical New Zealand genera as *Celmisia*, *Aciphylla*, *Coprosma*, *Phormium*, &c. In the shady moist depths of the forest tree-ferns and their smaller allies are abundant and the illustrations give a good idea of their size and beauty. The beautiful *Todea superba*, long an inhabitant of our gardens, fills much of the forest floor.

Mr. Turner enumerates some 320 species of plants that he found in this district, of which more than two-thirds are endemic to New Zealand—a remarkable proportion. Two other characteristics of the New Zealand flora are illustrated by this report: the abundance of epiphytic vegetation, and the extraordinarily polymorphic character of many of its species.

W. J. B.

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* Report on a Botanical examination of the Higher Waimarino District by E. Phillips Turner, Inspector of Scenic Reserves, Department of Lands, Wellington, New Zealand, 1909.